Eesti Maaülikool
Põllumajandus- ja keskkonnainstituut

SOUND through the NATURE

HELI LÄBI LOODUSE

Andi Järvsoo

Bakalaureusetöö keskkonnaplaneerimise ja maastikukujunduse erialal

Juhendaja: MSc. Jekaterina Balicka

Tartu 2018

Abstract

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Abstract of Bachelor's Thesis

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Curriculum: Institute of Agricultural and Environmental Sciences

Title: Sound through the nature

Pages: 24 Figures: 22 Tables: 1 Appendizes: 1

Department / Chair: Chair of Landscape Architecture
Field of research and (CERC S) code: T250
Supervisors: : Junior researcher Jekaterina Balicka, MSc
Place and date: Tartu 2018

The aim of this bachelor thesis was to create united solution for the Turu street and its surroundings. Proposed solution offers solutions to reduce traffic noise so that it can not reach pedestrians and citizens that lives near Turu street. Given project area had to be designed considering existing roads, buildings and green spaces.

Turu street is characterized by two main aspects - noise and nearness of river Emajõgi. Traffic noise is everydays problem for the citizens. Distracting sounds troubles primarily the people who live right next to the Turu street and also ordinary pedestrians that are moving there. Concept idea for this work was originated to guide pedestrians away from the noise and designing new connections for that. These solutions were based on the importance of the river Emajõgi. Created connections is combined with green corridors to change city space more human-friendly. Also, noise reducing elements were added to the two main areas to reduce incoming soundwaves. These designed elements are combined with the vegetation to make this resolution more efficient.

Keywords: Turu street, noise, connections

Lühikokkuvõte

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Bakalaureusetöö lõputöö lühikokkuvõte

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Õppekava: Keskkonnaplaneerimine ja maastikukujundus

Pealkiri: Heli läbi looduse

Lehekülgi: 24 Jooniseid: 22 Tabeleid: 1 Lisasid: 1

Osakond / Õppetool: Maastikuarhitektuuri õppetool
ETIS-e teadusvaldkond ja CERC S-i kood: T250
Juhendaja(d): : Nooremteadur Jekaterina Balicka, MSc
Kaitsmiskoht ja -aasta: Tartu 2018

Antud bakalaureusetöö eesmärgiks oli luua terviklik lahendus Turu tänavale ja selle ümbrusele. Esitatud lahendus pakub välja võimalusi, et vähendada jalakäijateni ning Turu tänava äärsete elanikeni jõudvat liiklusest põhjustatud müra. Antud projektala tuli kujundada võttes arvesse olemasolevad liiklusteed, hooned ning taimekooslused.

Turu tänavat iseloomustab kaks olulist tegurit- müra ning Emajõe lähedus tänavale. Iga päev on inimestel probleem liiklusmüraga. Häirivad valjud helid segavad eelkõige inimesi, kes elavad Turu tänava vahetus läheduses, kuid samuti ka tavalisi jalakäijaid, kes liiklevad seal. Antud töö konseptsioon lähtus lahendusest juhtida jalakäijad eemale liiklusmürast, luues selleks uued ühendusteed. Loodud ühendused on kujundatud koos rohekoridoridega, et muuta linnaruum inimesesõbralikumaks. Kahele alale on antud töös planeeritud elemendid, mis vähendaksid edasikanduvaid helilaineid. Need kavandatud elemendid on kombineeritud taimedega, et muuta lahendus veelgi tõhusamaks.

Märksõnad: Turu tänav, müra, ühendused

Table of contents

Introduction

The given project was composed as Estonian University of Life Sciences, Institute of Agricultural and Environmental Sciences, Chair of Landscape Architecture bachelor thesis. This thesis includes ideas and solutions for the Turu street development and its surroundings in city of Tartu. The main focus of the project is analysing and reducing noise that is problematic due to the Turu street intense traffic. The solution was to create a noise reducing elements and add more vegetation to block the noise more efficiently.
Also very important task was connecting pedestrians with the Emajõgi river and quide them away from the traffic induced noise pollution. The solution was to create an access to the river by creating promenade to the side of it. Created pathway connects Sõpruse bridge area and pedestrian bridge area next to the marketplace. A long pathway is also one of the factors that helps to guide pedestrians away from the distracting noise.

Location area

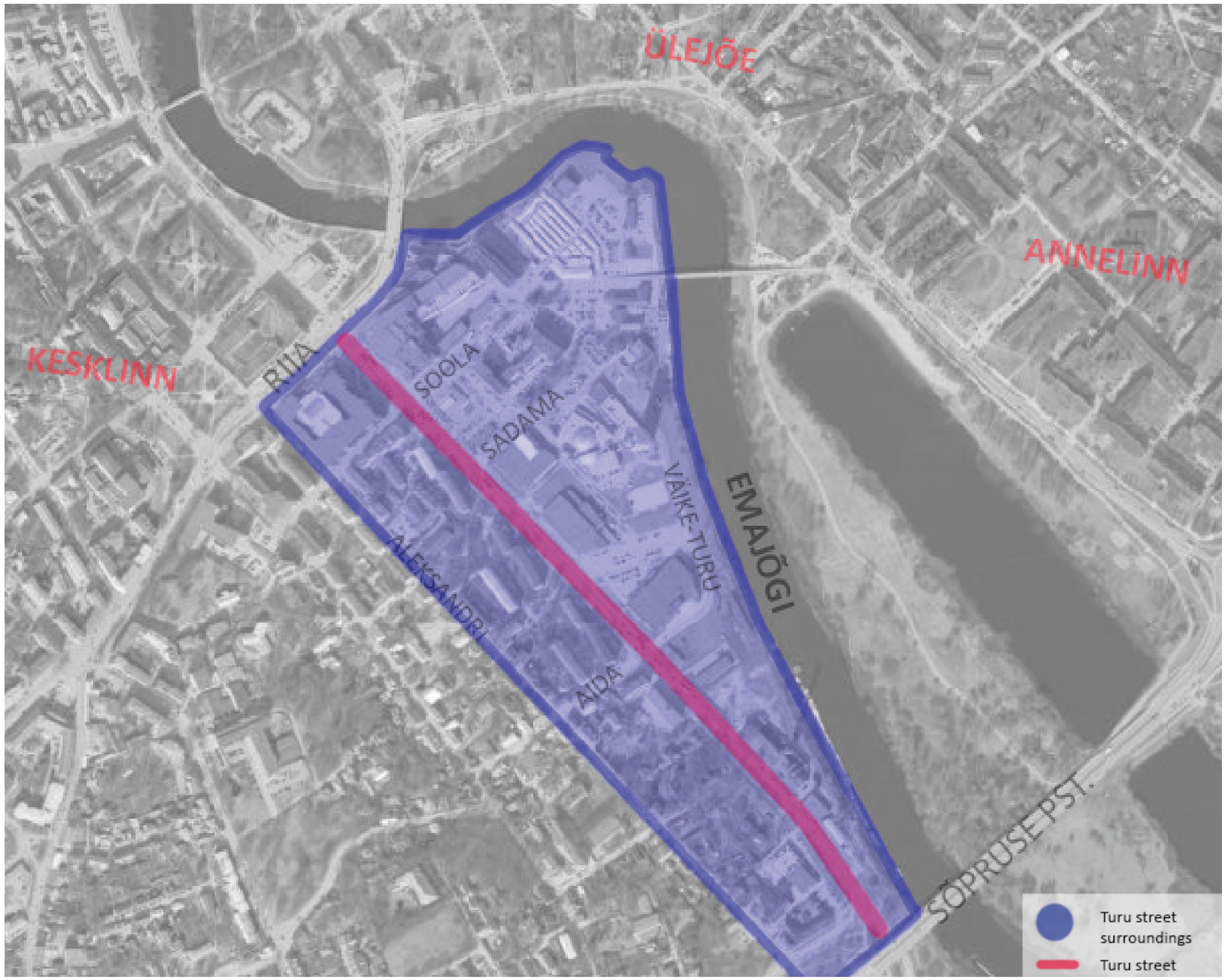


Figure 1. Location area

The territory of this project is located in Tartu consisting Turu street and its surroundings. This part of the Turu street is located between Sõpruse bridge and Võidu bridge. Turu street is one of the main streets in Tartu with Riia street which crosses Turu street next to the Võidu bridge and Tasku shopping mall. Given area is also quite close to the city centre.

Analysis

5. Apartment area: Apartment houses facing towards the Turu street are disturbed constantly with traffic induced noise.
This area does not have noise barriers and surrounding objects to block the noise.

4. Old district heating plant: This smaller area has old housing that does not have direct use anymore.
Its tall chimney is somewhat landmark right now. Around houses are potential green spaces that can be used to give this area new function.

4.1. Old Boat harbor: This old boat harbor area is placed behind old heating house. Right now it is not in good condition.

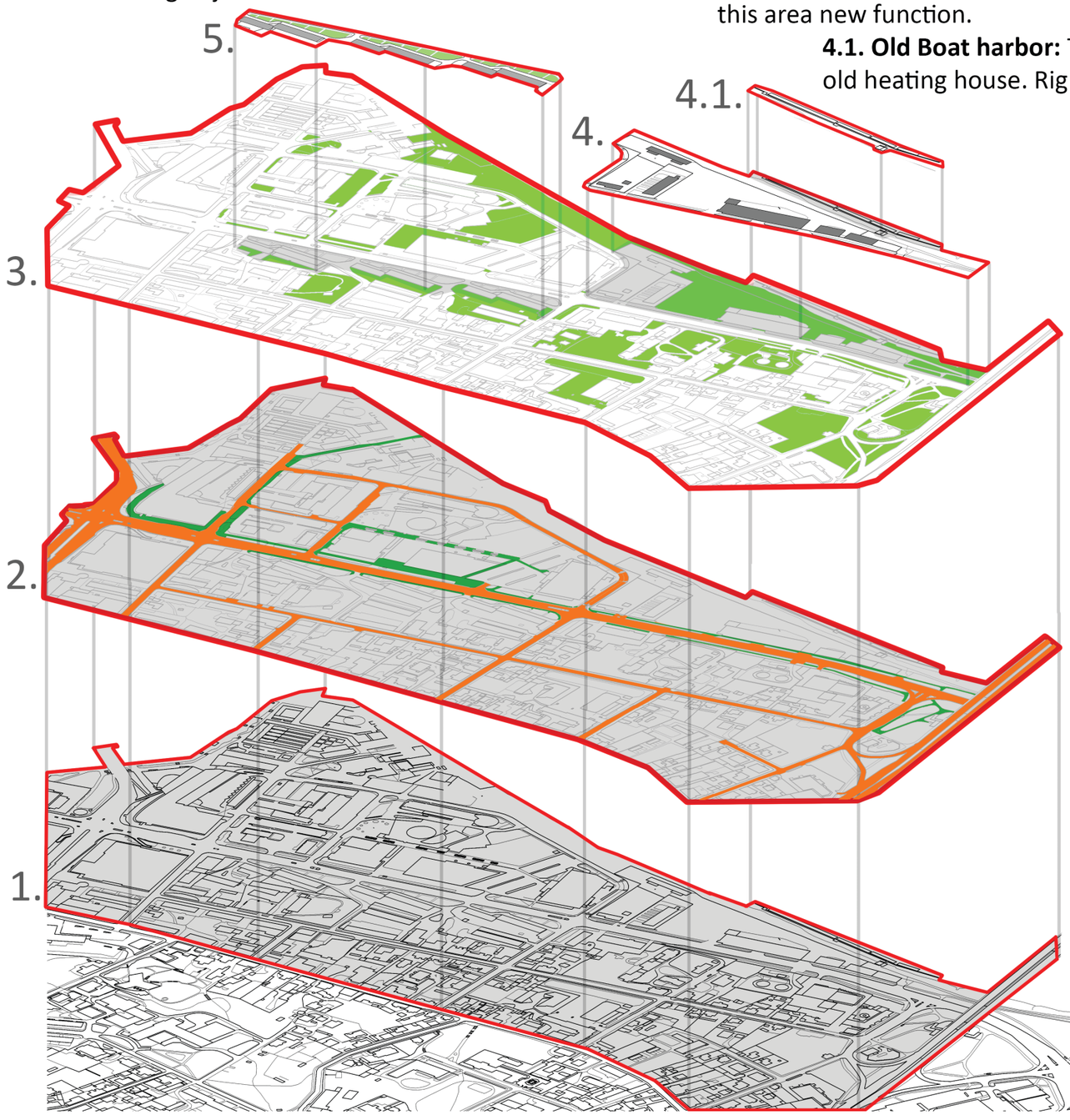


Figure 2. Layered axonometric analysis map

3. Green spaces: Turu street surrounded area does not have many quality green spaces.
This area also does not have parks and natural leisure places.
There is more greenery next to the river, but it is not well maintained and does not invite people to walk there.

2. Roads/connections: Turu street is quite well connected from the car owners view. It has main connection with Riia street. and other smaller streets. Problematic side is pedestrian roads and pathways. Existing ones are not functional or does not connect with each other.

2.1. Noise: One very important part which touches the road and connections is the noise pollution. Turu street is with very intense trafic which induces noise. Next to the street are apartment area where people who live there are interfiered with traffic noise daily.

1. Whole area: Turu street is one of the main streets in Tartu. Its surroundings and elements are different from each other.

Analysis. Noise pollution

What is noise?

Noise is basically sound waves which moves by vibrating through the air. That means noise is created by vibrations. For example, it can be understood by throwing a stone into the water. Waves which were created by the impact are the “Soundwaves”. If the noise induced waves reaches the ear it causes eardrums to vibrate (Dobson; Ryan, 2000).

Sound is considered not as distracting factor, but noise on the other hand is defined as a disturbing and polluting factor.

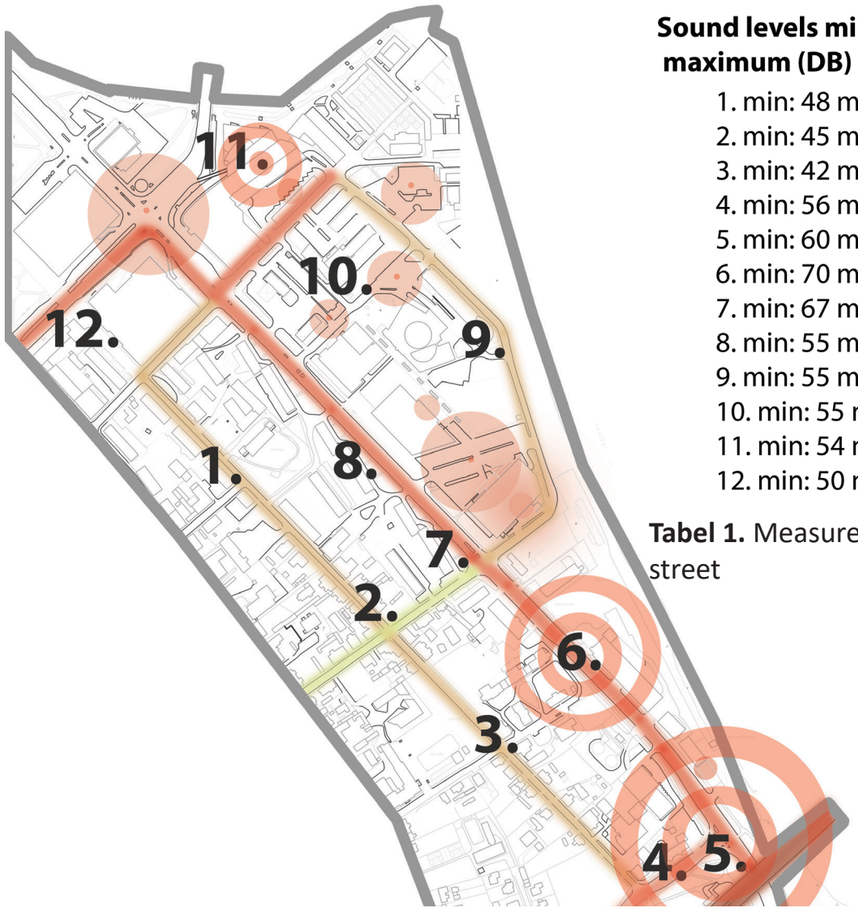


Figure 2. Layered axonometric analysis map.

Sound levels minimum and maximum (DB)

1. min: 48 max: 73
2. min: 45 max: 73
3. min: 42 max: 58
4. min: 56 max: 77
5. min: 60 max: 85
6. min: 70 max: 82
7. min: 67 max: 70
8. min: 55 max: 75
9. min: 55 max: 63
10. min: 55 max: 65
11. min: 54 max: 76
12. min: 50 max: 63

Tabel 1. Measured sound levels in the Turu street

Noise in the Turu street area

Turu street has a heavy traffic and that is one of the reason the noise from it radiates to the areas that does not take it well. Also this area has some spots that are generating or amplifying more noise. One of the spots like this is near the Sõpruse bridge. Bridge and space underneath it are acting like an amplifier.

Analysing the noise generating factors and collected sound levels, presumptions that were made at this stage of the work were true and expected.

Sound levels

Sound pressure levels are used to measure how intense sound is. These are described is decibel units. As whisper is around 20dB on the other hand jet aircraft noise levels are exploding over 110db (Dobson; Ryan, 2000) .

A given sound levels are collected with the sound level meter in the early stages of this work. These results were compared with the results that Tartu city itself has gathered.

Analysis. Current situation

1. On the left is shown area next to the apartment houses. The previous section about this area confirms that it is a plain area. It has some trees and green areas, but it is not enough to separate residential area from the street space.
2. This area continues after Sõpruse bridge. It is important to show how the project area and the other part of the Turu street can be connected.

3. Emajõgi river is one of the main elements which characterizes Tartu. Riversides has vegetation, but area does not have inviting sense to it. It has a lot of potential which needs to be make use of.
4. Sidewalk that is proceeding to the old heating plant is in good shape. It can be used to connect other sidewalks and pathways that is suggested to create with this work.Also, this spot has old trees and vegetation to mix with the new design.

5. Old boat harbor is not in good shape and does not have a inviting space around it. Riverside has a thin vegetation.

6. Next to the old boat harbor is placed a metal hangar that is rented out for the tire repair business. On the photo is shown that this area is not very inviting for the pedestrians because old tires that are lying around and its general status.

Analysis. Current situation. Sections

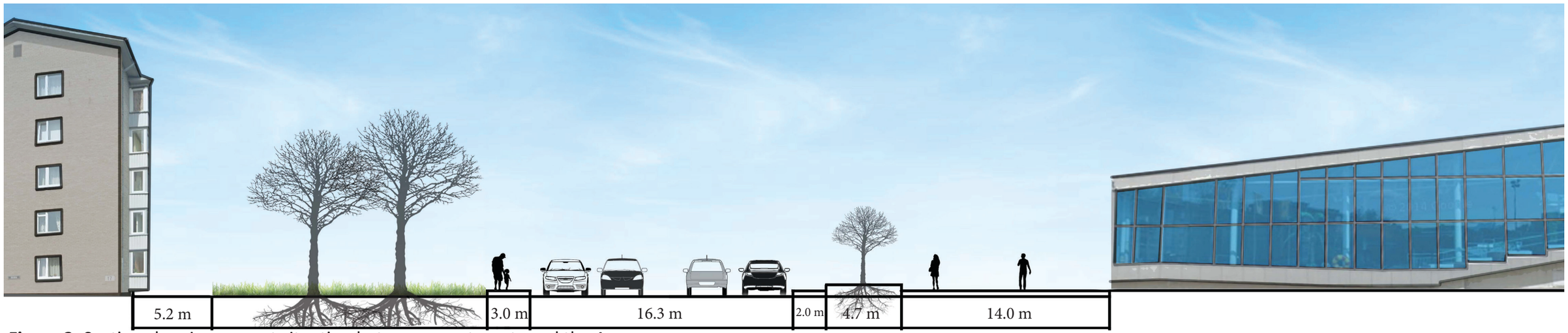


Figure 3. Section showing current situation between apartments and the Aura.

The space between the apartment houses and the Aura waterpark is currently plain and devoid. Apartment area does not have any good and useful noise protection. Turu street is producing traffic induced noise continuously throughout the day. Section shows that this space has some vegetation, but it is quite tenuous.

Secondly, old heating plant building area is currently very different from the other parts of the Turu street. Currently it consists of one main building, one smaller building and the hangar.

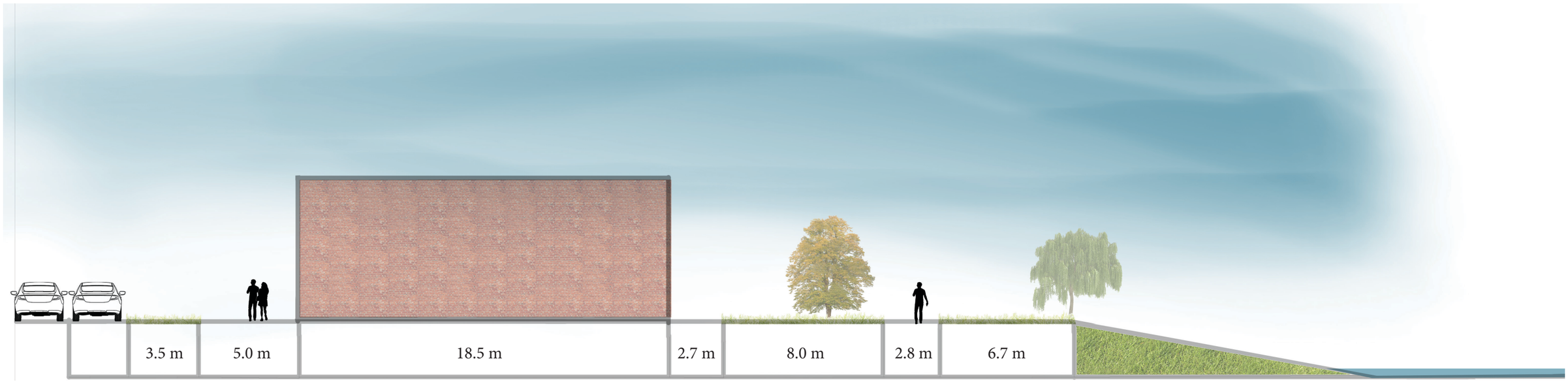


Figure 4. Section showing current situation between Turu street and the river.

Concept

Based on the previous analysis the main purpose of this work is to reduce the noise that is created by the Turu street intense traffic. To achieve that goal, this work offers out design idea for the project area.
To create more pedestrian friendly space this work suggest to construct promenade that connects Sõpruse bridge area with the marketplace and the Turu bridge (pedestrians bridge). That creates a possible corridor and calmer space that is leading pedestrians away from the traffic.

Figure 5. Concept map showing the new connections to guide away from the Turu street intense traffic

Reducing noise

Noise can be reduced by placing and creating sound barriers. These can be made from solid material, for example fences and raised ground. Hard surfaces reflect sound waves whereas softer surfaces reflect but also are absorbing sound (Hellis, 2018).

But always it can not be done because of surroundings and space limits. However noise can be still reduced effective by adding higher vegetation between the sound generating factor and more calmer space.

If trees and shrubs can be used in conjunction with solid barriers, such as raised ground, it is the best of all scenarios.

Noise can be reduced by using various methods:
Increasing the distance between the source and the hearer
Erecting a solid barrier
Planting trees and shrubs

Design plan
1:3000

One connection is also created behind the Zeppelin shopping centre that is designed to close the entrance for the ordinary user. The pathway and the green corridor connects to the promenade.
Also, vegetation next to the river is saved as much as possible to mix with the new planned greenery.

Given design plan is implemented to show how the new connections are created. Planned promenade follows the riverside and other smaller pathways are connected to it. The pathway is wide enough that people can walk there and it can also be used by the cyclists. Smaller building and the metal hangar are removed next to the old heating plant to open up the possibility to create an appropriate space with the new boat harbor. The new boat harbor is designed with the inspiration of the Karlova boat harbor and follows the same structure. Old district heating plant is reused as the boat maintenace building. For that purpose behind it is designed a canal that is accessable by boats. To maintain the promenade continuity there is planned a moving bridge. Bridge is opened only rarely so that boats can access the building.

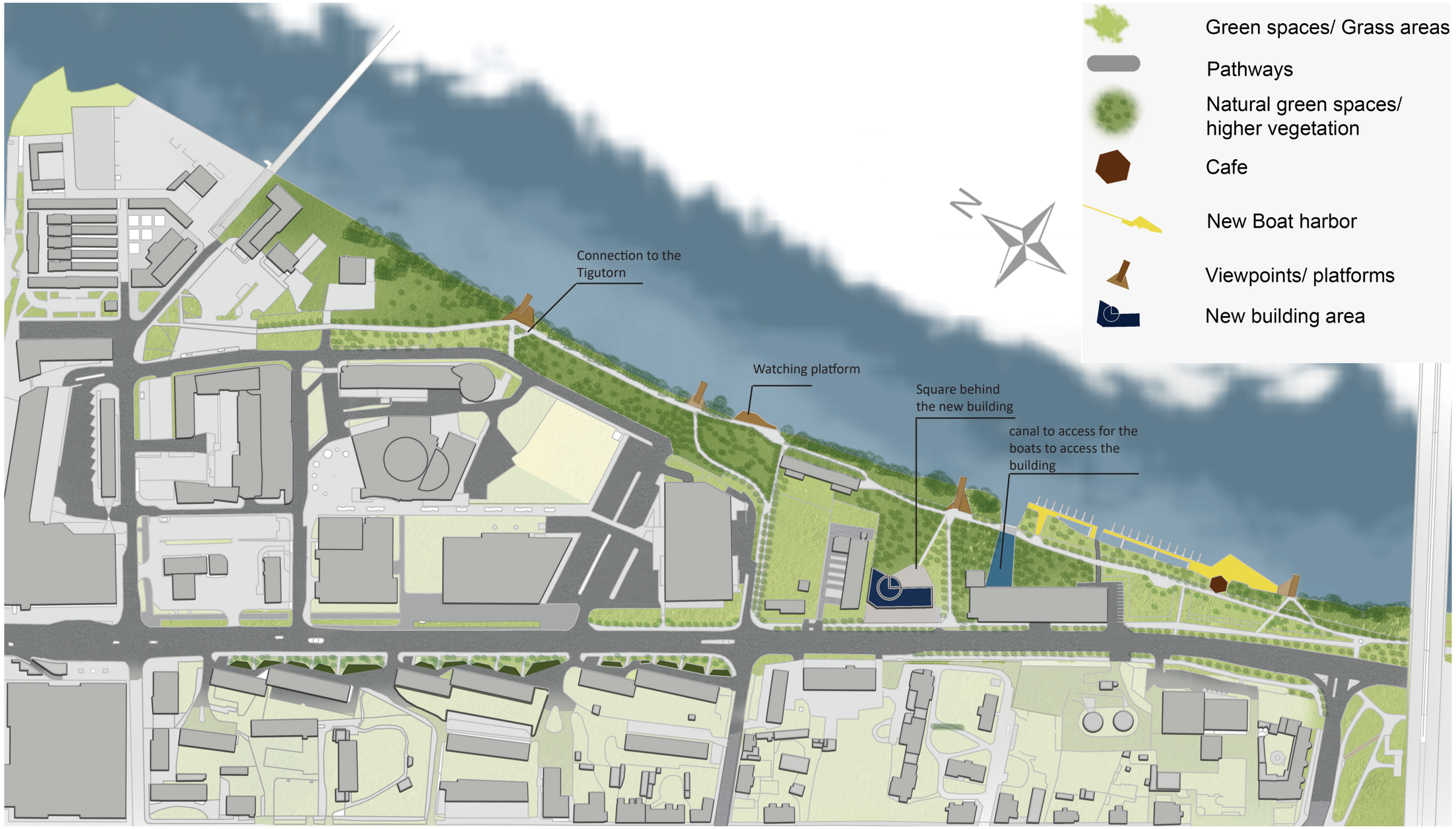


Figure 6. New design plan showing whole project area and new planned spaces. (Design plan 1:3000)

Design plan 1

1:500

One of the main designed areas in this thesis is located around the old boat harbor and the old district heating plant. The new idea is that old boat harbor is replaced with the new one. The purpose of this process is to create more inviting space and view for the pedestrians. Also, this zoom shows how the promenade pathway is placed.
Between the boat harbor platform and the pathway is placed a cafe to invite people to enjoy views of the river in the summer.

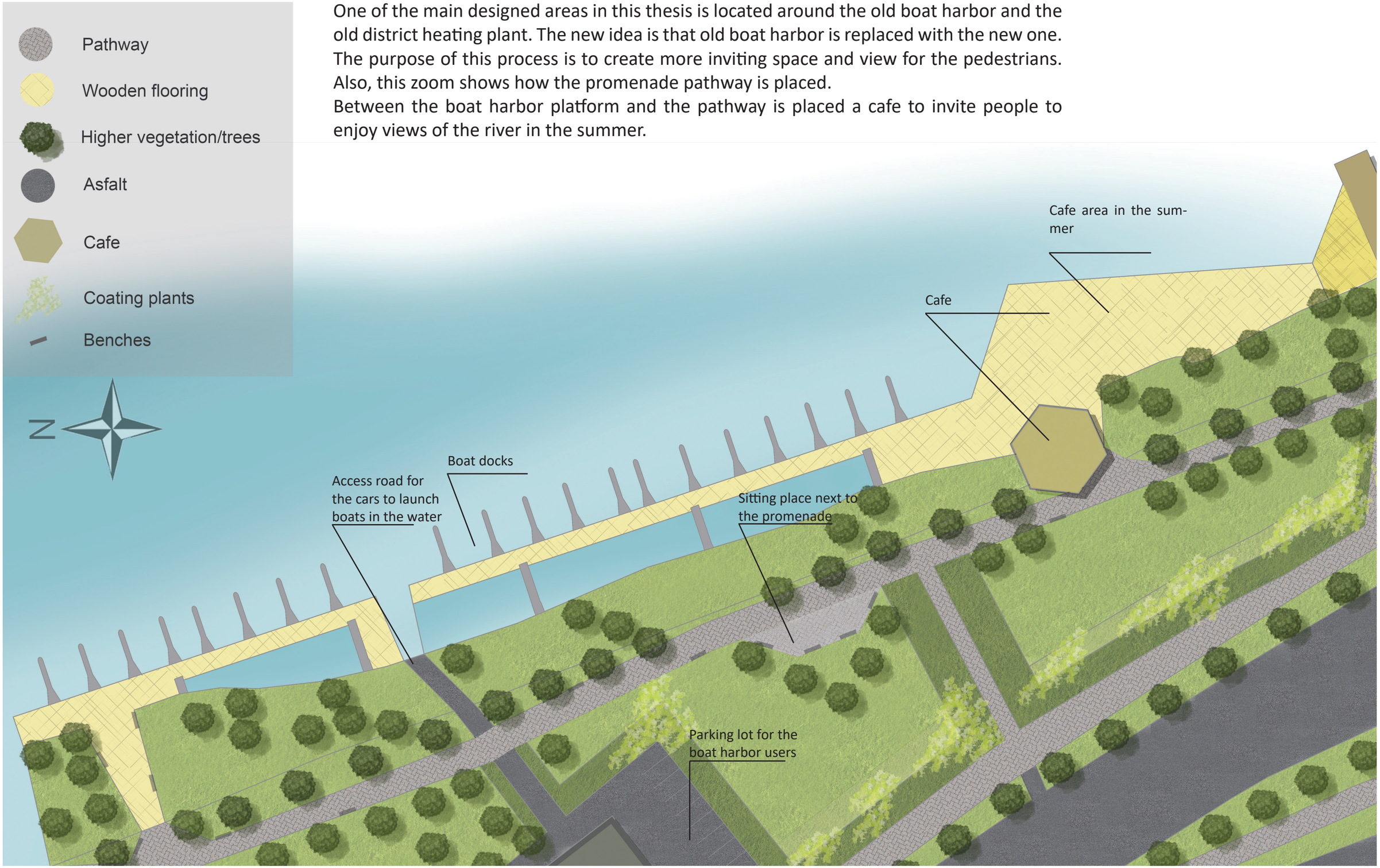


Figure 7. New design around the district heating plant to show new boat harbor area. **(**Design plan 1:500)

Section 1
1:200

A - A`

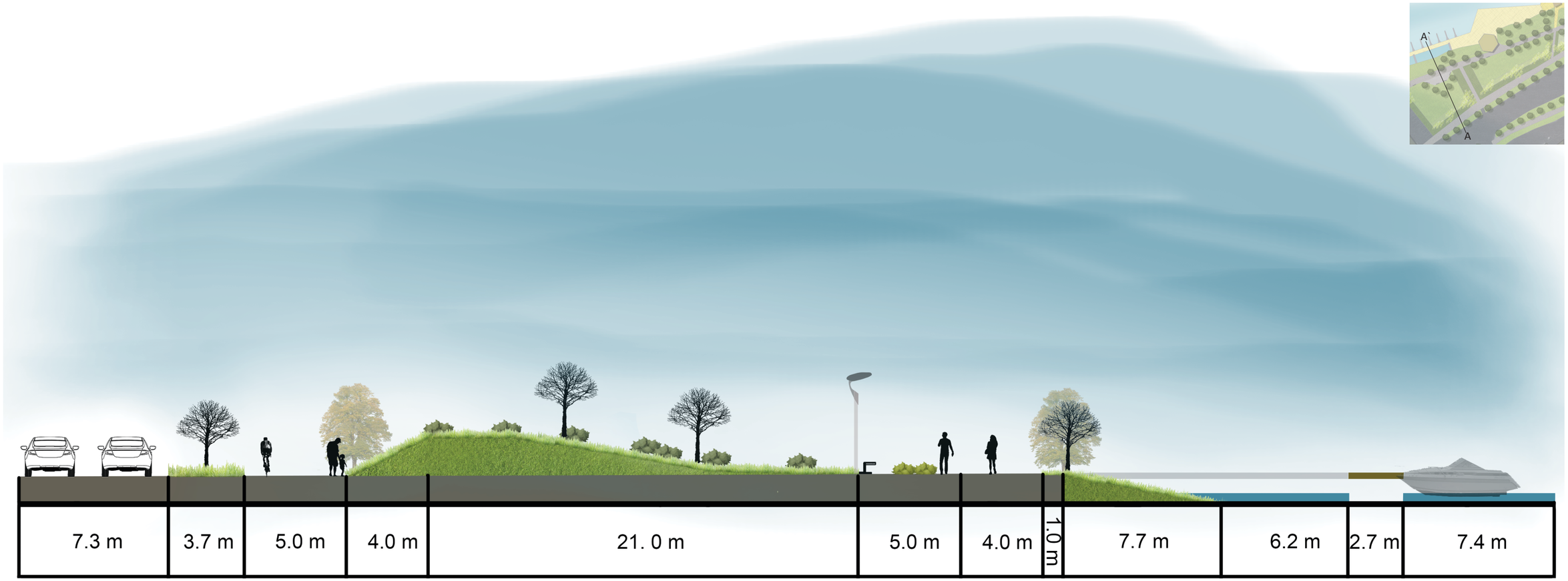


Figure 8. Section between Turu street and the new boat harbor. (Section 1:200)

Between the boat harbor and the Turu street is changed considering the previous analysis and concept idea to separate traffic and street noise with the riverside. Existing green area/green stripe that is dividing car road from the sidewalk will be kept untouched . However, there will be added new trees to help along the noise reducing process.

Main noise reducing element in this area will be the raised ground to keep promenade and boat harbor area calm and peaceful. This raised element is cooperating with the vegetation that will be planted on the higher ground. Also roots of the trees, bushes and the ground covering plants will help against the erosion on slopes.

After the raised ground along the riverside is designed a promenade and a smaller square with benches. This given purpose is for the people to relax and watch the boat harbor. Potentially, people can use designed space to enjoy the river festivals and other planned events.

Along the promenade is placed new lighting and benches that is shown on the section.

Design plan 2

1:500

The second area that is designed in this work applies to the residential area. The area in the front of the apartments is designed to reduce incoming traffic noise. Elements that are used are designed same as the boat harbor raised ground. That follows the same concept and new vegetation that is added is helping residents to live there more comfortably.

The green connection that runs behind the Zeppelin and connects to the promenade is essential to connect Karlova side with the Aida street. The green connection will close the Väike-Turu street partly. Little part is still usable for the maintenace vehicles and the transporter vehicles to access the Zeppelin shopping centre.

Figure 9. Design plan to show apartment area and the connection behind the Zeppelin. (Design plan 1:500)

Section 2

1:200

B - B`

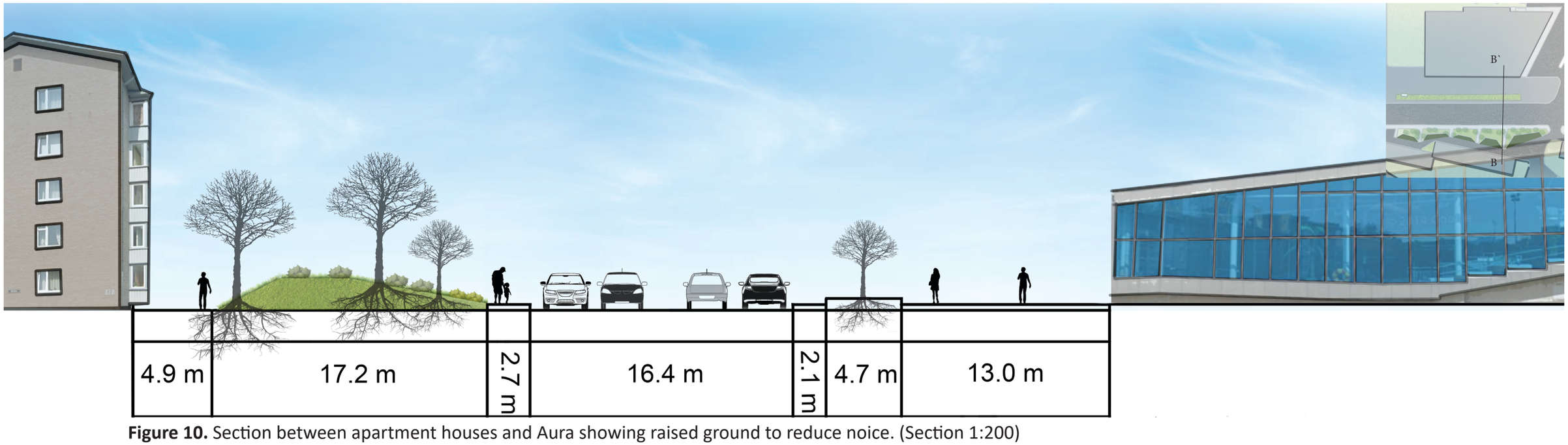


Figure 10. Section between apartment houses and Aura showing raised ground to reduce noice. (Section 1:200)

An area that is in front of the apartment houses is designed using previous analysis and concept idea. The new design is mainly for the citizens who lives there. Using the raised ground element similar to the new boat harbor area is helpful piece that will reduce incoming traffic noise. Elevated ground is planned with slopes to not create a visual blocking wall. Second cause for the incline is that sound waves are bouncing away. That means noise does not travel straightly to the destination point.

The new landscape element is combined with the vegetation to boost the noise reduction even more efficiently. However the territory is not too crowded with plants not to create a full visual blocking wall to the street.

Section 3

1:100

C - C`

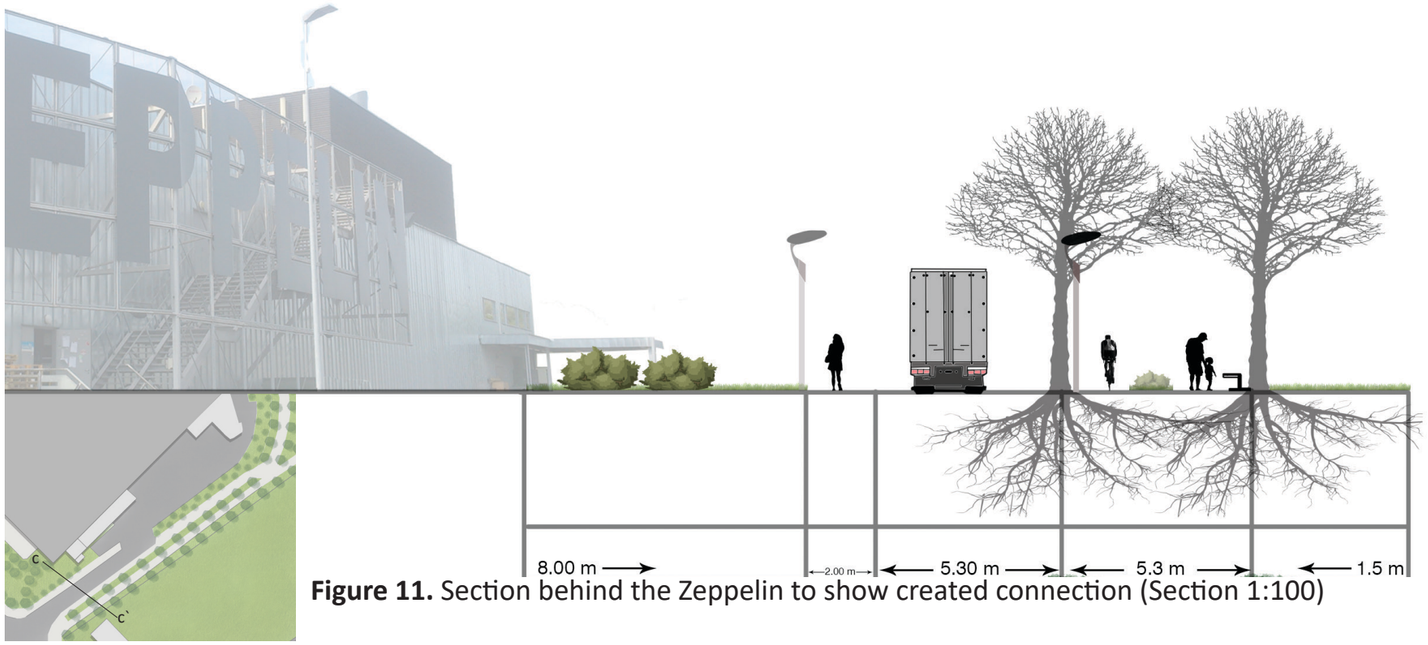


Figure 11. Section behind the Zeppelin to show created connection (Section 1:100)

One connection is created behind the Zeppelin shopping centre. Väike-turu street is closed partially, but maintenace vehicles and trucks can still access the building.

New pathways that are planned are connecting to the planned promenade. These are accessible also for the cyclists because the road is divided into two parts. Connection corridor is surrounded with trees that is inspired by the sides of the river and the promenade.

Planting plan

1:100

New plants that are planned in this area are shown on this planting plan.
Every symbol on the plan represents one unit of specific plant in real life.

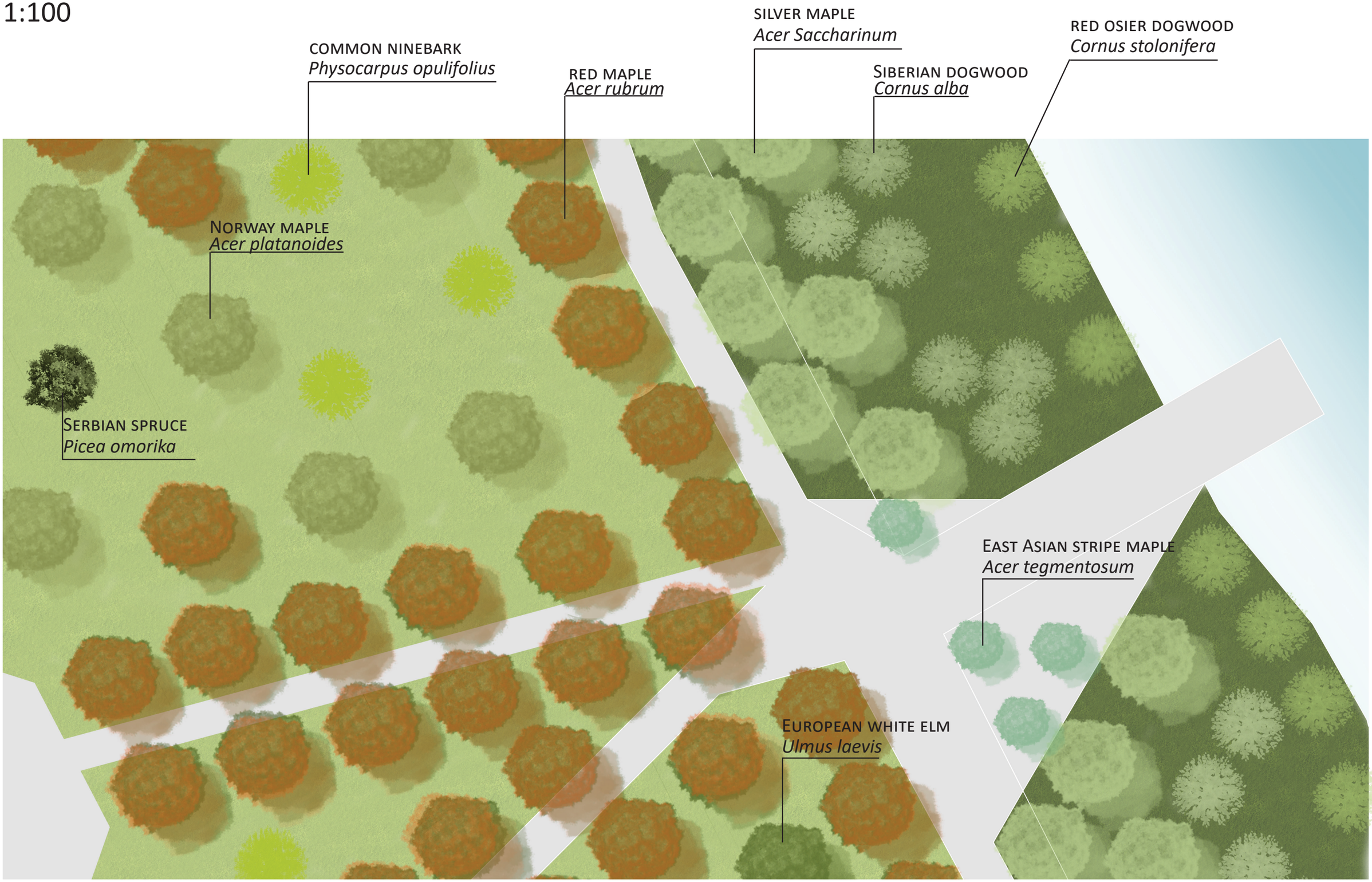


Figure 12. Planting plan showing the space around the new building area with new plants. (PLanting plan 1:100)

Planting plan

1:250

New plants that are planned in this area are shown on this planting plan.
Every symbol on the plan represents one unit of specific plant in real life.

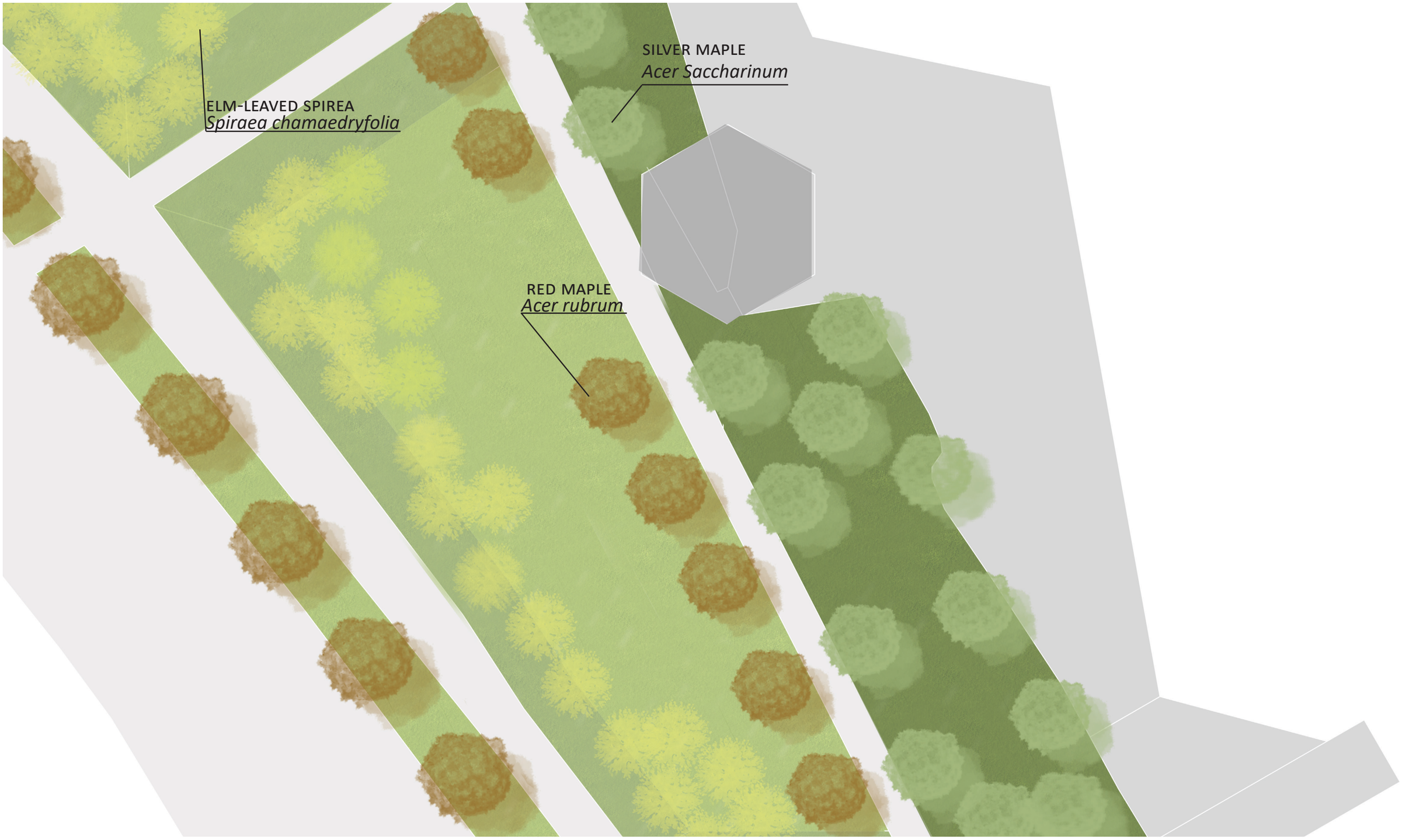


Figure 13. Planting plan showing new planned plants on the raised ground and next to the promenade. (Planting plan 1:250)

Detail. Riverside watching platform

1:50

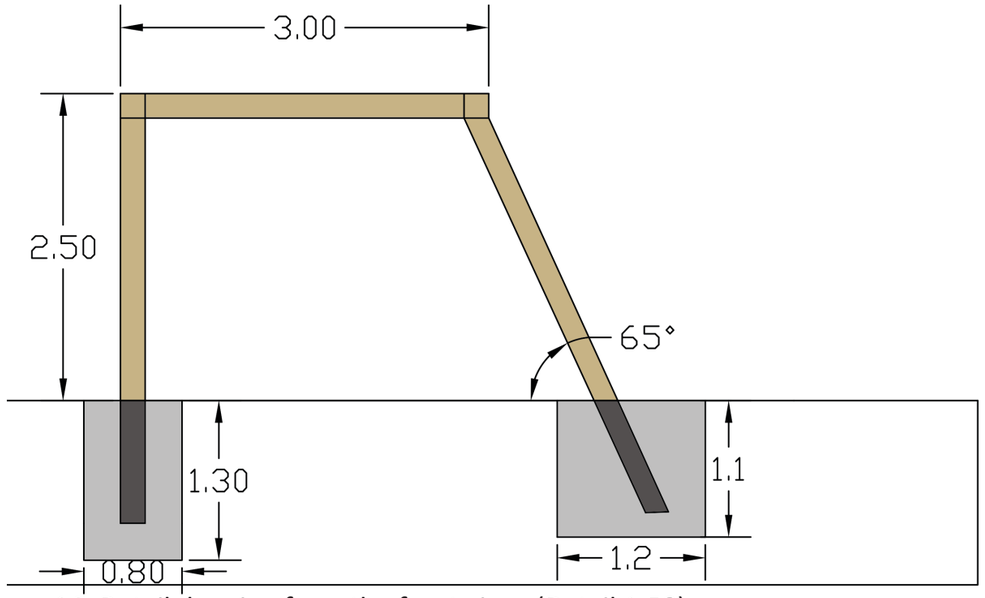


Figure 14. Detail drawing from the front view. (Detail 1:50)

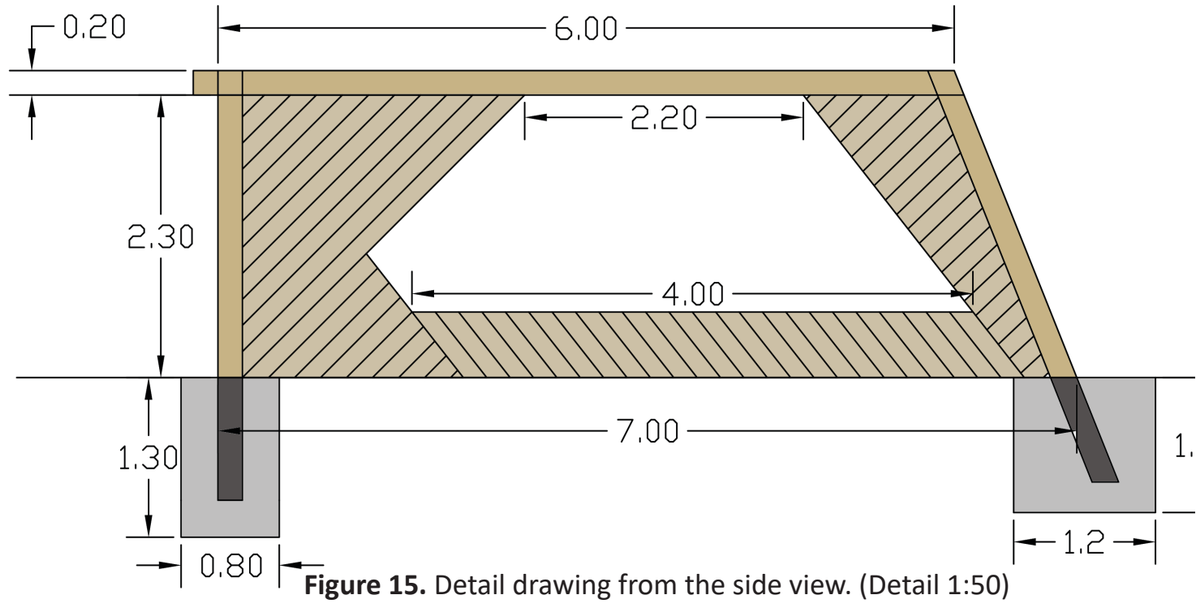


Figure 15. Detail drawing from the side view. (Detail 1:50)

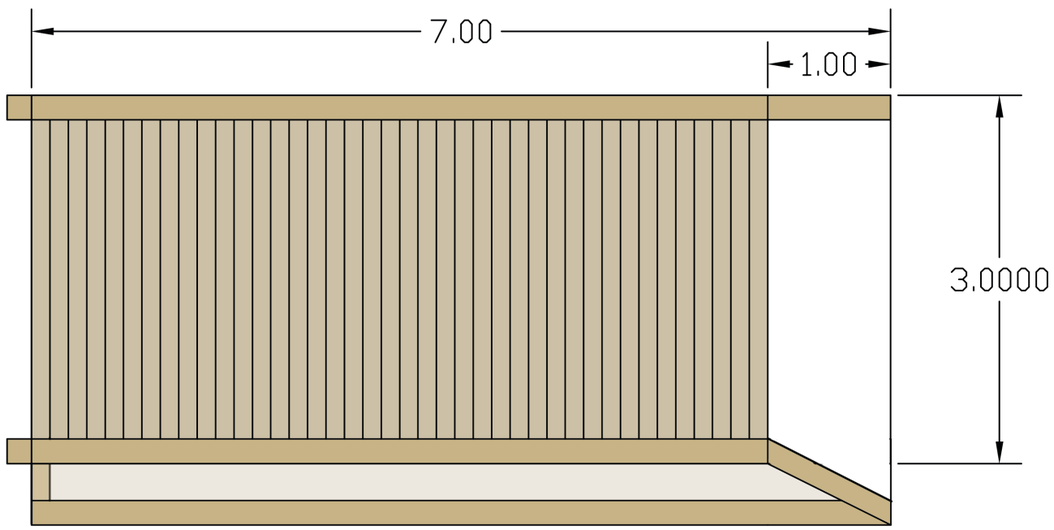


Figure 16. Detail drawing from the top view. (Detail 1:50)

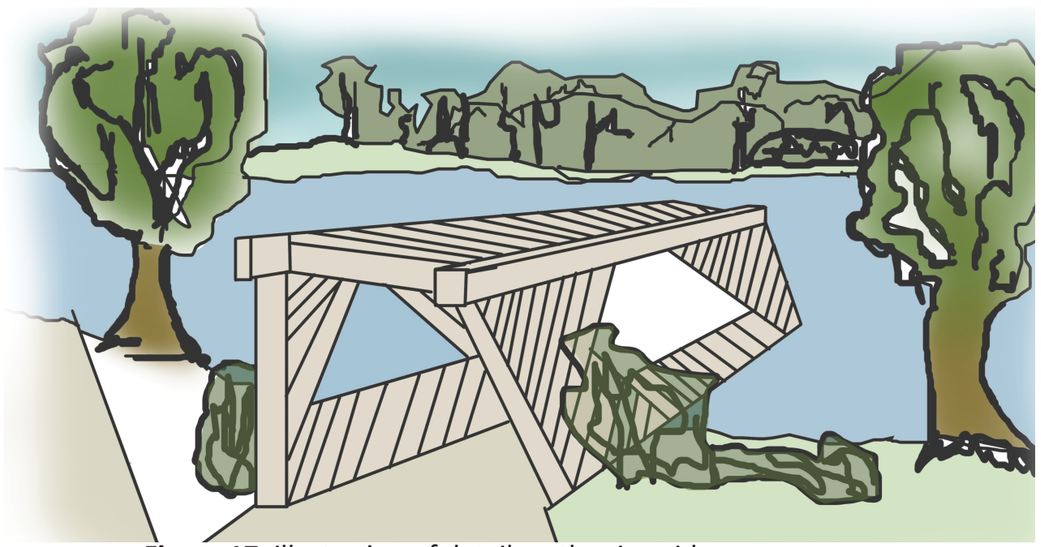


Figure 17. illustration of detail on the riverside.

Raised ground element

1:50

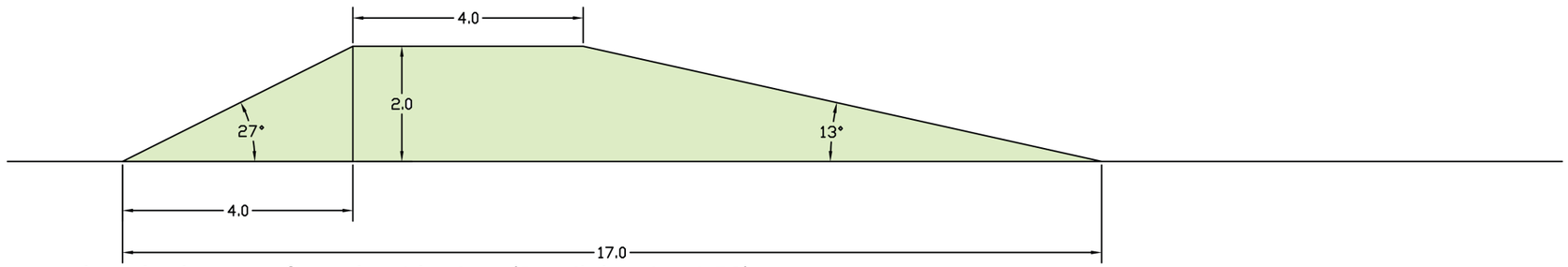


Figure 18. Raised ground element in the new boat harbor area from the side view. (Detail drawing 1:50)

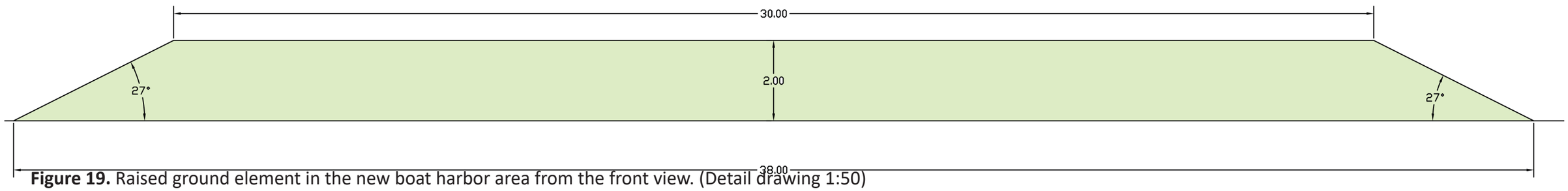


Figure 19. Raised ground element in the new boat harbor area from the front view. (Detail drawing 1:50)

Bench & lighting detail 1:20

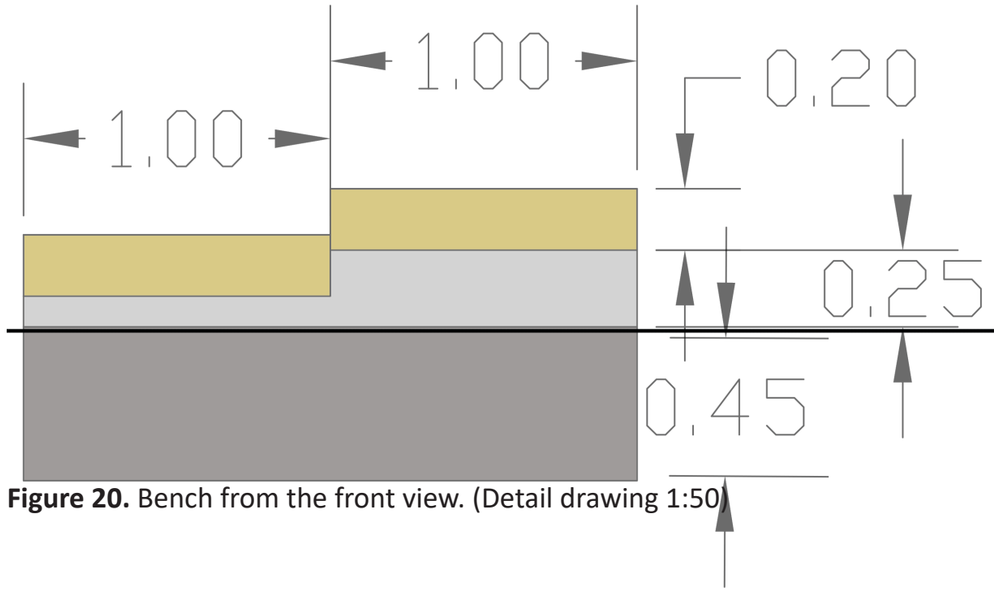


Figure 20. Bench from the front view. (Detail drawing 1:50)

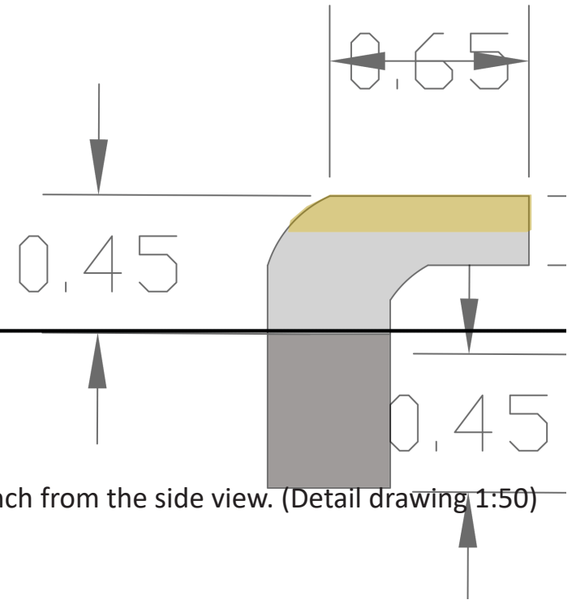
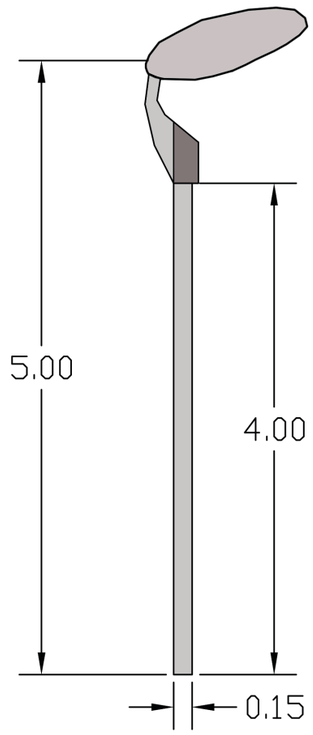


Figure 21. Bench from the side view. (Detail drawing 1:50)



Vertical plan

1:200 Raised ground between the new boat harbor and the street

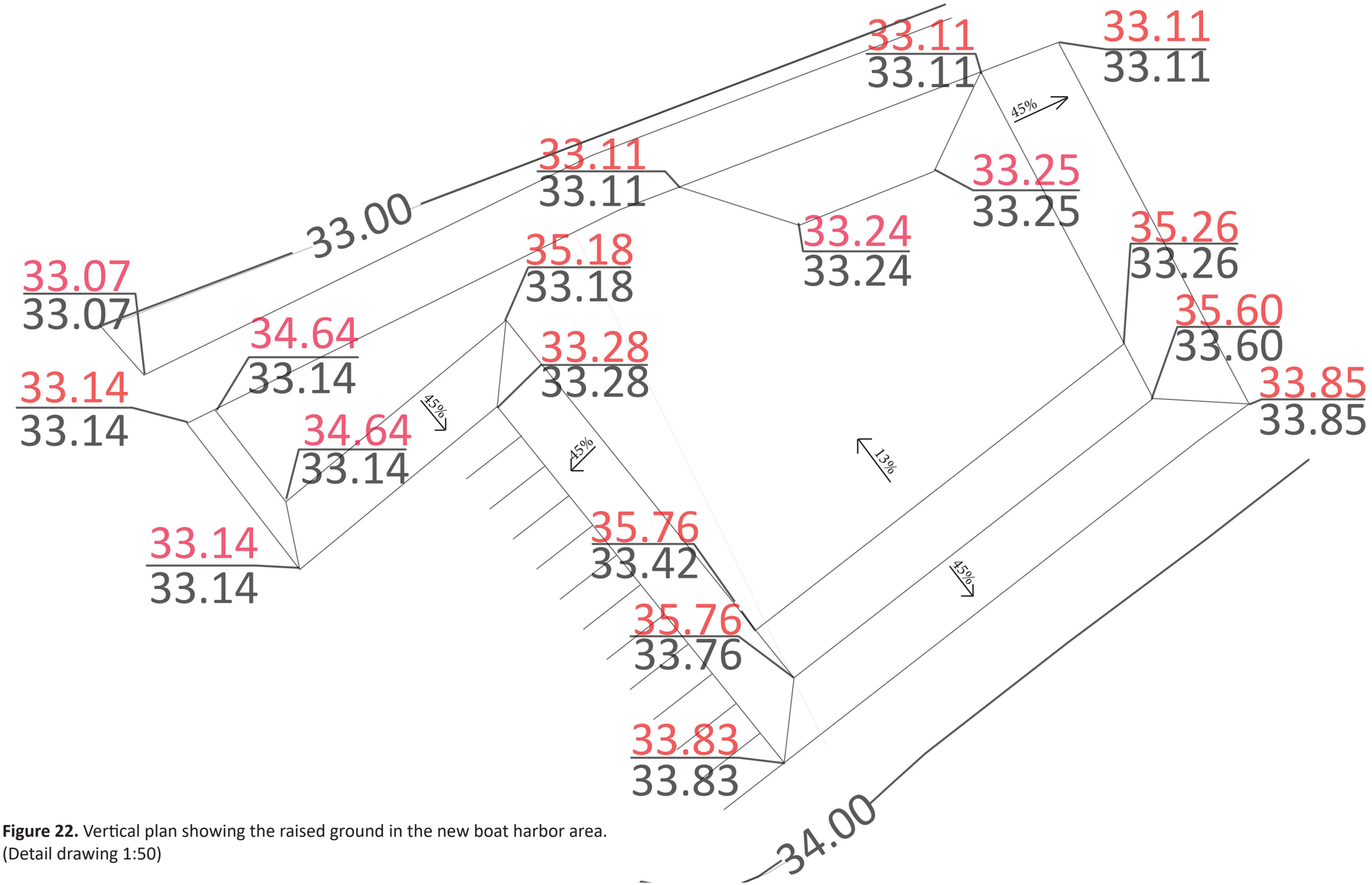


Figure 22. Vertical plan showing the raised ground in the new boat harbor area. (Detail drawing 1:50)

Summary

Turu street is characterized by two main aspects - noise and nearness of river Emajõgi. It is a everydays struggle to cope with the traffic noise. Distracting sounds troubles primarily the people who live right next to the Turu street and also ordinary pedestrians that are moving there. The main focus of the project was analysing and reducing noise that is problematic due to the Turu street intense traffic. The solution was to create a noise reducing elements and add more vegetation to block the noise more efficiently. Also very important task was connecting pedestrians with the Emajõgi river and quide them away from the traffic induced noise pollution.
In this bachelor work it is suggested a solution that will make current space more citizen friendly. Proposed solution to the raised problem is to guide pedestrians away from the traffic noise and create elements that will reduce incoming soundwaves. These designed elements are combined with the vegetation to make this resolution more efficient.

Kokkuvõte

Turu tänavat iseloomustab kaks olulist tegurit- müra ning Emajõe lähedus tänavale. Iga päev on inimestel probleem liiklusmüraga. Häirivad valjud helid segavad eelkõige inimesi, kes elavad Turu tänava vahetus läheduses, kuid samuti ka tavalisi jalakäijaid, kes liiklevad seal. Põhiliseks eesmärgiks antud töös oli analüüsida ning vähendada müra, mis on problemaatiline täna Turu tänava intensiivsele liiklusele.
Pakutud lahenduseks luua müra vähendavad elemendid ning lisada rohkem haljastust ja taimi, et takistada müra veelgi efektiivsemalt. Samuti väga oluline ülesanne oli jalakäijatele ühenduse loomine Emajõega ning juhtida inimesed eemale liilklusest.
Käesolevas bakalaureuse töös on tehtud ettepanekud lahendusteks, mis muudaksid hetkese tänavaruumi palju kodaniku sõbralikumaks. Perfektne vastus tõstatatud probleemile on juhtida jalakäijad eemale liiklusmürast ning luua elemendid, mis vähendaksid edasikanduvaid helilaineid. Need kavandatud elemendid on kombineeritud taimedega, et muuta lahendus veelgi tõhusamaks.

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Lihtlitsents lõputöö salvestamiseks ja üldsusele kättesaadavaks tegemiseks ning juhendaja(te) kinnitus lõputöö kaitsmisele lubamise kohta

Mina, Andi Järvsoo,
(autori nimi)
sünniaeg 26.01.1996 ,

1. annan Eesti Maaülikoolile tasuta loa (lihtlitsentsi) enda koostatud lõputöö
Sound through the nature ,
(lõputöö pealkiri)

mille juhendaja(d) on Jekaterina Balicka, MSc
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